

AMENDMENT TO THE CLAIMS

The following claim set replaces all prior versions, and listings, of claims in the application:

1. (currently amended) A polyisobutenamine of the formula I:

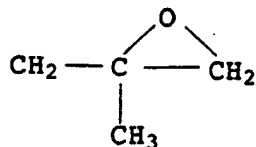


where R is a polyisobutenyl radical having a number average molecular weight M_N of from 500 to 1500 and a polydispersity M_W/M_N of no more than 1.3 and is derived from a polyisobutene which is the product of an isobutene polymerized in the presence of an initiator system comprising:

- a) a Lewis acid selected from covalent metal chlorides and semimetal chlorides,
- b) and at least one compound of the formula III,

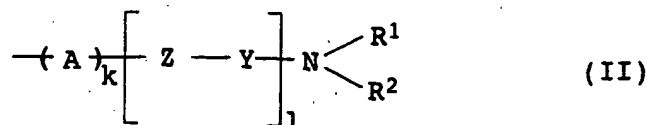


where m is 0, 1, 2, 3 or 4 and FG is halogen, OH, alkoxy, acyloxy, $CH_2C(CH_3)CH_2OH$ or a group



in a solvent which is inert with respect to the Lewis acid, at a molar ratio of Lewis acid to compound III of from 5:1 to 1:20, to give a polyisobutene which contains at least 80 mol % of olefinic terminal groups and has a number average molecular weight M_N of from 500 to 1300 and a polydispersity M_W/M_N of no more than 1.3; and

X is a radical of the formula II



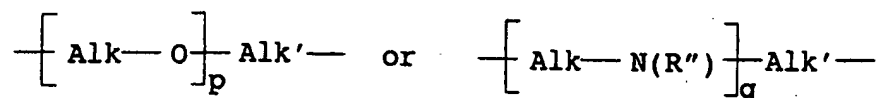
where k and 1, independently of one another, are 0 or 1,

A is methylene or phenylene,

Z is oxygen or NR', where

R' is hydrogen, alkyl, hydroxyalkyl, aminoalkyl, cycloalkyl, aryl, aralkyl or a group -Y-NR¹R²,

-Y- is a group



where Alk is C₂-C₄-alkylene, p and q, independently of one another, are an integer from 0 to 25 and R'' is hydrogen, alkyl or aryl, and Alk' is alkylene which may be interrupted by 1, 2 or 3 nonneighboring oxygen atoms, or is cycloalkylene,

R¹ and R², independently of one another, are hydrogen, alkyl, cycloalkyl, hydroxyalkyl, aryl or aralkyl or a group Y-NR³R⁴, where Y has the abovementioned meanings and R³ and R⁴, independently of one another, are hydrogen, alkyl, cycloalkyl, hydroxyalkyl, aryl or aralkyl, R³ and R⁴ together with the nitrogen atom to which they are bonded form an unsubstituted or substituted, saturated heterocycle which may contain a further hetero atom selected from oxygen and nitrogen,

R¹ and/or R² may also be R or -CH₂-R if 1 is 0, R having the abovementioned meaning, or

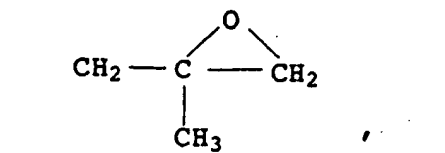
R¹ and R² together with the nitrogen atom to which they are bonded form an unsubstituted or substituted, saturated heterocycle which may contain a further hetero atom selected from oxygen and nitrogen, and

the polyisobutenamine is obtained by a process wherein

- i) isobutene is polymerized in the presence of an initiator system comprising:
- a) a Lewis acid selected from covalent metal chlorides and semimetal chlorides, and
 - b) at least one compound of the formula III,



where m is 0, 1, 2, 3 or 4 and FG is halogen, OH, alkoxy, acyloxy, CH₂C(CH₃)CH₂OH or a group



in a solvent which is inert with respect to the Lewis acid, at a molar ratio of Lewis acid to compound III of from 5:1 to 1:20, to give a polyisobutene which contains at least 80 mol % of olefinic terminal groups and has a number average molecular weight M_N of from 500 to 1500 and a polydispersity M_W/M_N of no more than 1.3, and

- ii) a radical having amino groups is introduced at the olefinic double bonds of the polyisobutene obtained in step i).

2. (original) A polyisobutenamine as claimed in claim 1, where R^1 and R^2 , independently of one another, are selected from hydrogen, C_1 - C_6 -alkyl, phenyl, 2-hydroxyethyl, 2-aminoethyl, 3-aminopropyl, 2-di(C_1 - C_4 -alkyl)aminoethyl, 3-di(C_1 - C_4 -alkyl)aminopropyl or radicals of the formulae $[\text{CH}_2\text{-CH}_2\text{-O}]_p\text{-CH}_2\text{-CH}_2\text{OH}$ and $[\text{CH}_2\text{-CH}_2\text{-NH}]_q\text{-CH}_2\text{-CH}_2\text{NH}_2$, or where NR^1R^2 is a piperidine, piperazine, N-(C_1 - C_4 -alkyl)piperazine or morpholine radical and p' and q' , independently of one another, are from 1 to 20.

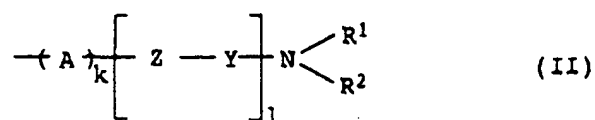
3. (currently amended) A process for the preparation of a polyisobutenamine of the formula I:



where

R is a polyisobutenyl radical having a number average molecular weight M_N of from 500 to 1500 and a polydispersity M_W/M_N of no more than 1.3, and

X is a radical of the formula II



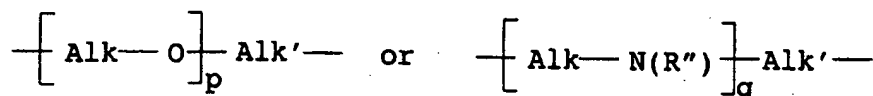
where k and 1, independently of one another, are 0 or 1,

A is methylene or phenylene,

Z is oxygen or NR', where

R' is hydrogen, alkyl, hydroxyalkyl, aminoalkyl, cycloalkyl, aryl, aralkyl or a group $-\text{YNR}^1\text{R}^2$,

-Y- is a group



where Alk is C₂-C₄-alkylene, p and q, independently of one another, are an

integer from 0 to 25 and R'' is hydrogen, alkyl or aryl, and Alk' is alkylene which may be interrupted by 1, 2 or 3 nonneighboring oxygen atoms, or is cycloalkylene,

R¹ and R², independently of one another, are hydrogen, alkyl, cycloalkyl, hydroxyalkyl, aryl or aralkyl or a group $\text{Y-NR}^3\text{R}^4$, where Y has the abovementioned meanings and R³ and R⁴, independently of one another, are hydrogen, alkyl, cycloalkyl, hydroxyalkyl, aryl or aralkyl, R³ and R⁴

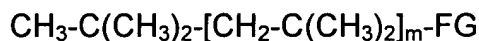
together with the nitrogen atom to which they are bonded form an unsubstituted or substituted, saturated heterocycle which may contain a further hetero atom selected from oxygen and nitrogen.

R¹ and/or R² may also be R or -CH₂-R if 1 is 0, R having the abovementioned meaning, or

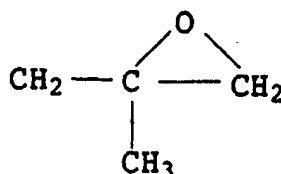
R¹ and R² together with the nitrogen atom to which they are bonded form an unsubstituted or substituted, saturated heterocycle which may contain a further hetero atom selected from oxygen and nitrogen;

the process comprising the steps of:

- i) polymerizing isobutene in the presence of an initiator system comprising
 - a) a Lewis acid selected from covalent metal chlorides and semimetal chlorides,
 - b) and at least one compound of the formula III,



where m is 0, 1, 2, 3 or 4 and FG is halogen, OH, alkoxy, acyloxy, CH₂C(CH₃)CH₂OH or a group



in a solvent which is inert with respect to the Lewis acid, at a molar ratio of Lewis acid to compound III of from 5:1 to 1:20, to give a polyisobutene which contains at least 80 mol % of olefinic terminal groups and has a number average molecular weight M_N of from 500 to 1300 and a polydispersity M_W/M_N of no more than 1.3, and

- ii) introducing a radical having amino groups at the olefinic double bonds of the polyisobutene obtained in step i).

4. (original) A process as claimed in claim 3, wherein the compound III is used in an amount of from 0.02 to 0.3 mol per mole of isobutene.

5. (previously presented) A process as claimed in claim 3, wherein the Lewis acid is selected from titanium(IV) chloride and boron trichloride.

6. (previously presented) A process as claimed in claim 3, wherein the initiator system additionally contains at least one aprotic polar compound IV which is suitable for complex formation with the Lewis acid or with the carbocation formed under reaction conditions or the cationogenic complex of Lewis acid and compound III.

7. (original) A process as claimed in claim 6, wherein the compound IV is selected from pyridine, alkylpyridines and nonpolymerizable, aprotic organosilicon compounds having at least one Si-O bond.

8. (previously presented) A process as claimed in claim 6, wherein the compound IV and the compound III are used in a molar ratio of IV:III of from 1:1 to 1:1000.

9. (previously presented) A process as claimed in claim 3, wherein the solvent for the polymerization is selected from hydrocarbons of 2 to 10 carbon atoms, inert halohydrocarbons of 1 to 3 carbon atoms and mixtures thereof.

10. (previously presented) A process as claimed in claim 3, wherein the solvent is removed at temperatures of at least 150°C in order to obtain the polyisobutenes.

11. (previously presented) A process as claimed in claim 3, wherein the functional group X in step ii) is introduced by reaction of the polyisobutene obtained in step i), according to one of the following processes (1) to (7), and, if required, a subsequent alkoxylation:

- (1) hydroformylation of the polyisobutene with subsequent reductive amination of the hydroformylation product in the presence of

ammonia, amines or amino alcohols and hydroformylation of the polyisobutene in the presence of ammonia, amines or amino alcohols under reducing conditions;

- (2) hydroboration of the polyisobutene with subsequent oxidative cleavage of the borane adduct and subsequent reductive amination in the presence of ammonia, amines or amino alcohols;
- (3) hydroboration or hydroformylation under reducing conditions to give a polyisobutenyl alcohol, followed by an alkoxylation and a reductive amination in the presence of ammonia, amines or amino alcohols;
- (4) reaction of the polyisobutene with a nitrogen oxide-containing oxidizing agent and subsequent reduction of the NO_x groups thus introduced to NH₂ groups;
- (5) epoxidation of the polyisobutene and subsequent reaction of the epoxidation product with ammonia, an amine or an amino alcohol with subsequent or simultaneous elimination of water and catalytic reduction;
- (6) hydrocyanation of the polyisobutene under acidic catalysis and subsequent hydrolysis in a Ritter reaction or
- (7) reaction with phenol under Friedel-Crafts conditions and subsequent reaction of the polyisobutenylphenol with formaldehyde and amine in a Mannich reaction.

12. (previously presented) A method for reducing deposits in valves, carburetors or injection systems of an internal combustion engine, comprising adding to a fuel a deposit reducing effective amount of a polyisobutenamine as claimed in claim 1.

13. (original) An additive concentrate containing at least one polyisobutenamine as claimed in claim 1 in amounts of from 0.1 to 80% by weight, in addition to a fuel additive component other than the polyisobutenamine.

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14. (previously presented) A fuel composition containing a principal amount of a liquid hydrocarbon fuel and a detergent-active and/or viscosity-improving amount of at least one polyisobutenamine as claimed in claim 1.